WE CLAIM:

1. A fabric and tape laying machine operable with: (a) a robot including programmable control means, (b) a supply roll containing a continuous strip of composite tape or fabric, and (c) a mold, plug or mandrel of predetermined surface shape relative to x, y and z coordinates, comprising:

a. a chassis mountable to said robot and movable by said robot for laying said tape or fabric onto said mold along a programmed path that is straight with respect to said x and y coordinates and follows contours of said predetermined surface shape with respect to said z coordinate,

b. means on said chassis for supporting said supply roll,

c. a contact roller module mounted on said chassis and spaced apart and downstream from said supply roll and adapted to receive said tape from said supply roll, said contact roller module being carried by said chassis as said chassis is moved along said programmed path,

d. a tape cutting unit carried by said chassis and situated between said supply roll and said contact roller module,

e. a first set of feed rollers downstream of said supply roll and upstream of said tape cutting unit, and a second set of feed rollers downstream of said tape cutting unit and upstream of said contact roller module for driving said tape from said supply roll and maintaining said tape taut while it passes through said tape cutting unit, and driving said tape to said contact roller module, said tape extending from said supply roll to said tape-cutting unit having opposite generally parallel side edges,

f. said tape-cutting unit comprising at least one cutter to cut a predetermined profile along one of said opposite sides of said tape as said tape is moving through said tape-cutting unit and/or to cut said tape transversely to have a predetermined length when it covers a predetermined surface area of said mold,

g. said contact roller module comprising at least one modular frame, a set of three pressure contact rollers carried by said at least one said frame,

namely a center roller and two side rollers in end-to-end relationships, said at least one set of pressure contact rollers adapted to have said tape received from said tape-cutting unit pass around said pressure contact rollers and be laid onto said mold, and where each of said side rollers has its central axis angularly displaceable relative to the central axis of said central roller, and

h. a suspension system for dynamically energizing said contact roller module to have its rollers apply a predetermined level of force downward on said tape during the lay-up process regardless of any varying contours on said mold surface.

2. A tape-laying machine according to Claim 1 wherein said contact roller module further comprises at least one follower element situated adjacent and generally parallel to and behind said pressure contact rollers for contacting and pressing portions of tape not contacted by said pressure contact rollers.

3. A tape-laying machine according to Claim 1 wherein said tape on said supply roll includes an adjacent strip of protective film, and said chassis further comprises a take-up roll, said protective film being separated from said tape and fed onto said take-up roll.

4. A tape-laying machine according to Claim 1 wherein said center roller is mounted at a fixed orientation and location on said frame of said contact roller module.

5. A tape-laying machine according to Claim 2 wherein said at least one set of pressure contact rollers has a combined axial length L, and said at least one follower element has axial length substantially the same as L.

6. A tape-laying machine according to Claim 5 wherein said follower element is a roller.

7. A tape-laying machine according to Claim 1 wherein said tape defines a plane as it extends from said cutting unit to said contact roller module, and wherein said pressure contact rollers of said contact roller module lie in a plane generally perpendicular to said plane of said tape, said center roller positioned with its central axis of rotation a fixed perpendicular distance from said frame and perpendicular to the direction of said tape movement, said side rollers having their

respective central axis pivotable relative to said central axis of said center roller, said contact roller module further comprising at least one follower element situated adjacent and generally parallel to and behind said contact pressure rollers with respect to said path traversed by said contact roller module, said at least one follower element pressing said laid tape against said mold.

8. A tape-laying machine according to Claim 1 wherein each of said modular frames comprises a base, and wherein said center roller has opposite ends and each of said side rollers has an inner end adjacent one of said opposite ends of said center roller and has an outer end, and wherein said modular frame further comprises (a) a pair of spaced-apart fixed arms which extend from said base and rotatably support said opposite ends of said center roller and pivotably and rotatably support said inner ends of said side rollers, and (b) a pair of length-extendable arms, each having one end pivotably connected to said outer end of each of said side rollers and an opposite end pivotably connected to said base.

9. A tape-laying machine according to Claim 7 comprising a plurality of said contact roller modules, each having a frame with said three contact pressure rollers in end-to-end configuration with the adjacent frame, and with the outer end of one side roller pivotally coupled to the outer end of the adjacent side roller of the adjacent modular frame, with said end-to-end aligned modular frames forming a first tier of the tape-dispensing head structure.

10. A tape-laying machine according to Claim 9 wherein each of said frames with its three rollers is a modular sub-assembly with respect to an adjacent frame, with the adjacent side rollers of each two adjacent frames remaining pivotally coupled together such that all the rollers of all the frames always define a continuous line in a single plane.

11. A tape-laying machine according to Claim 10 wherein each of said length-extendable arms comprises a telescoping piston and cylinder, the piston being axially energized by said control means to configure the aligned rollers to be compliant with said mold surface.

12. A tape-laying machine according to Claim 8 wherein said tape-dispensing head comprises a base and a plurality of said modular frames fixed to

said base and situated such that the central axis of the two outer and center rollers of each modular frame lie in a plane, and said planes of said plurality of modular frames are co-planar, and each of said modular frames is adjacent to at least one other modular frame with the outer ends of one side roller of each of said adjacent modular frames being adjacent and pivotally coupled together, and with said rollers of said plurality of modular frames being configurable so that their respective central axes define a continuous line that may be concave, convex, wavy, sinusoidal or other shape.

13. A tape-laying machine according to Claim 1 wherein each of said center and side rollers is nominally two inches long.

14. A tape-laying machine according to Claim 1 wherein said control means directs the configuration of the side rollers of each of said modular frames independently of each other and independently of the rollers of the adjacent sub-frames, except that each two adjacent side roller of adjacent modular frames must remain coupled to each other.

15. A tape-laying machine according to Claim 1 wherein said predetermined path is defined by successive points, each being at a specified elevation relative to a reference plane, and said predetermined path further defines at each of said points a surface contour defined by a line perpendicular to said path, whereby at each of said points said chassis frame is controlled to position the center roller on said line and at said specified elevation, and to position said side rollers on both sides adjacent said center roller at an angle and elevational as defined by said path.

16. A tape-laying machine according to Claim 1 wherein said chassis frame of said tape dispensing head has top and bottom parts with said tape moving in the direction from top to bottom in a generally flat plane, said tape-cutting unit comprising a beam having a cutter support surface generally parallel to said plane of said tape and generally perpendicular to said top-to-bottom direction, said pair of cutters being movable on said support surface transversely of said tape movement direction.

17. A tape-laying machine according to Claim 16 wherein said tape-cutting unit comprises a pair of knives, water, air or laser cutters, each movable transversely on said beam independently of the other.

18. A tape-laying machine according to Claim 1 wherein said mold surface defines at least a portion of an airplane wing, fuselage, nacelle or propeller blade, or of a boat hull, automotive body, satellite component, windmill blade or building component.

19. A tape-laying machine according to Claim 1 wherein said supply roll can be replaced or supplemented between passes of the tape-dispensing head so that the tape laying can be continuous regardless of the length or the breadth of the mold onto which it is laid.

20. A tape-laying machine according to Claim 1 further comprising a heater for heating said tape after is passes said tape-cutting sub-assembly and before it reaches said contact roller module.

21. A tape-laying machine according to Claim 1 further comprising a cooler for maintaining cool said tape on said supply roll and said fabric tape extending from said supply roll to said contact roller module.

22. A method of performing composite fabric or tape lay-up onto a mold surface with a tape laying machine that uses a supply roll of tape and includes a tape cutting unit and a contact roller module, comprising the steps:

a. defining the topography of said mold surface,

b. directing a contact roller module to traverse a plurality of successive passes, each pass generally parallel to and laterally displaced from the prior pass, where each pass follows a path which defines a portion of said topography, and

c. providing a dynamic suspension system which urges pressure contact rollers of said contact roller module to push against said mold surface with substantially the same force at all times regardless of the changes in topography of the mold as the contact roller module passes are made.

23. A method according to Claim 22 comprising the further step for each strip dispensed with each pass of said tape dispensing head,

a. determining the profiles of opposite side edges profile and the length of each strip should have before said contact roller module makes the pass,

b. directing said tape cutting unit to cut said edge profiles as said tape is moving toward said mold, and to make a transverse cut across said tape to establish the predetermined strip length.